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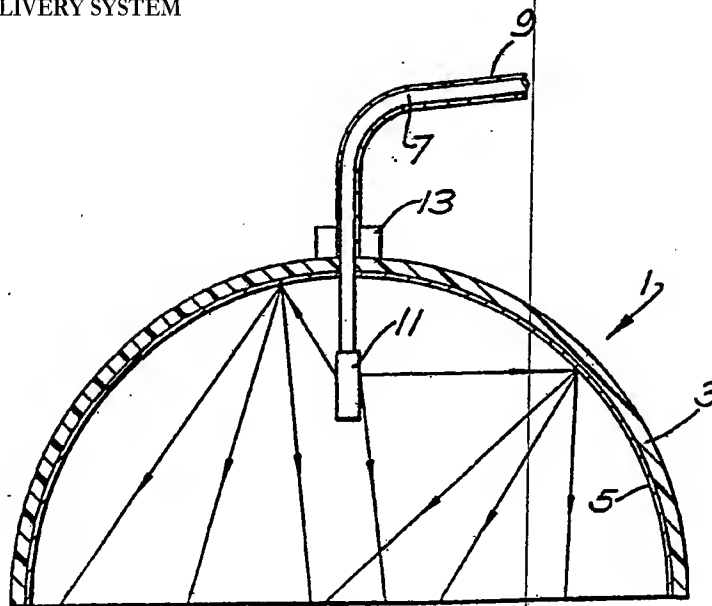
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(54) Title: LIGHT DELIVERY SYSTEM



(57) Abstract

A device for uniformly irradiating an area of a surface which accurately reflects light from the area and scatters it back towards the surface. The device comprises a hemispherical shell (3) whose inside surface is coated with a diffusely reflecting material and a light source (11) mounted in the shell. The light source may be a diffusing device connected to a laser remote from the shell (3) via an optical fibre (7). In use the shell (3) is placed against the surface under illumination so that the edges of the shell (3) define the area under illumination. A deformable sheet of partly reflective and translucent material is placed across the open mouth of the hemisphere to cover the target area to increase the uniformity of illumination when the device is used on uneven surfaces. The device is particularly useful in photodynamic therapy.

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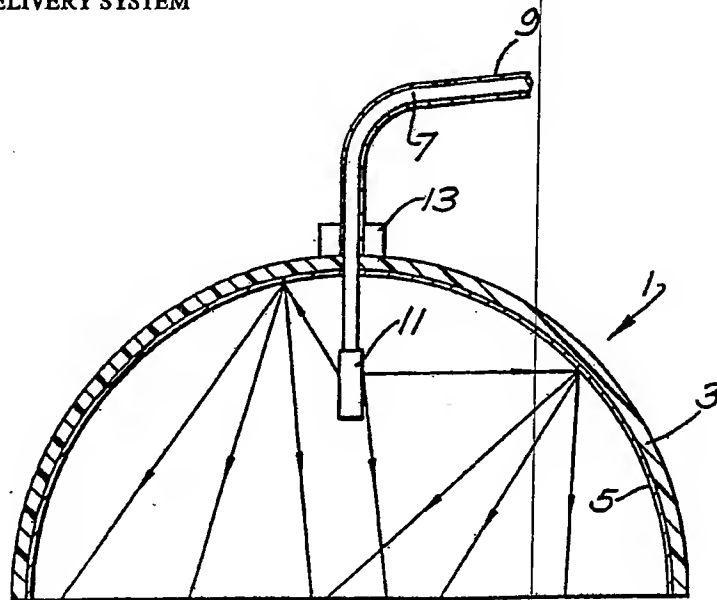
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<p style="text-align: center;">FOR THE PURPOSES OF INFORMATION</p> <p>Codes used to identify States party to the PCP on the front pages applications under the PCP.</p> <table><tr><td>AT</td><td>Austria</td><td>FS</td><td>Spain</td></tr><tr><td>AU</td><td>Austnda</td><td>FT</td><td>Fmlmd</td></tr><tr><td>BR</td><td>Barbados</td><td>FR</td><td>France</td></tr><tr><td>BE</td><td>Belgium</td><td>GA</td><td>Gabon</td></tr><tr><td>BF</td><td>Burkina Farn</td><td>GB</td><td>United Kingdom</td></tr><tr><td>BG</td><td>Bulgaria</td><td>HU</td><td>Hungary</td></tr><tr><td>RI</td><td>Benin</td><td>IT</td><td>Italy</td></tr><tr><td>BR</td><td>Braise</td><td>JP</td><td>Japan</td></tr><tr><td>CA</td><td>Canada</td><td>BP</td><td>Demoaalief People's Republic of Korea</td></tr><tr><td>CF</td><td>CcntralAMrant Republic</td><td>KR</td><td>Republic of Corca</td></tr><tr><td>CG</td><td>Congo</td><td>u</td><td>Liechtenstein</td></tr><tr><td>CFL</td><td>Swizerbnd</td><td>LK</td><td>Sri Lanka</td></tr><tr><td>Ctrl</td><td>Cameroon</td><td>W</td><td>Luxembourg</td></tr><tr><td>DE</td><td>Germany, Federal Republic of</td><td>MC</td><td>Monaco</td></tr><tr><td>DK</td><td>Denmark</td><td></td><td></td></tr></table>		AT	Austria	FS	Spain	AU	Austnda	FT	Fmlmd	BR	Barbados	FR	France	BE	Belgium	GA	Gabon	BF	Burkina Farn	GB	United Kingdom	BG	Bulgaria	HU	Hungary	RI	Benin	IT	Italy	BR	Braise	JP	Japan	CA	Canada	BP	Demoaalief People's Republic of Korea	CF	CcntralAMrant Republic	KR	Republic of Corca	CG	Congo	u	Liechtenstein	CFL	Swizerbnd	LK	Sri Lanka	Ctrl	Cameroon	W	Luxembourg	DE	Germany, Federal Republic of	MC	Monaco	DK	Denmark			<p>pamphlets publishing international</p> <table><tr><td>MG</td><td>Madagascar</td></tr><tr><td>ML</td><td>Mali</td></tr><tr><td>MR</td><td>Mauritania</td></tr><tr><td>MW</td><td>Malawi</td></tr><tr><td>NL</td><td>Netherlands</td></tr><tr><td>NO</td><td>Mornay</td></tr><tr><td>RO</td><td>Romania</td></tr><tr><td>SD</td><td>Sudan</td></tr><tr><td>SE</td><td>Sweden</td></tr><tr><td>SI</td><td>Senegal</td></tr><tr><td>SU</td><td>Soviet Union</td></tr><tr><td>TD</td><td>Chad</td></tr><tr><td>TG</td><td>Togo</td></tr><tr><td>US</td><td>United States of America</td></tr></table>		MG	Madagascar	ML	Mali	MR	Mauritania	MW	Malawi	NL	Netherlands	NO	Mornay	RO	Romania	SD	Sudan	SE	Sweden	SI	Senegal	SU	Soviet Union	TD	Chad	TG	Togo	US	United States of America
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LIGHT DELIVERY SYSTEM

This invention relates to an apparatus and method for illuminating an area of an object and in particular to a device in which the total amount of luminant energy delivered to the area can be accurately determined. It is particularly applicable to medical treatment techniques which rely on the illumination of body tissue in order to achieve desired effects e.g. photodynamic therapy and bio-stimulation.

It has been found that certain types of cancer including skin cancer and breast cancer can be treated successfully using a technique known as photodynamic therapy or PDT. In this technique a photosensitizing agent, usually haematoporphyrin derivative (HpD) is administered to the patient and this agent concentrates in the cancerous tissue. It is thought that the agent concentrates in the tumour because it leaks out of the vasculature in the tumour into the surrounding tumour tissue. The lymphatic system within the tumour is not as efficient at removing the HpD as is the lymphatic system in the rest of the body and so for a certain time period there is proportionately more HpD in the tumour than in the rest of the body. At some point in that time period the area of the body with the tumour is irradiated with laser light having a wavelength of about 630

nm! from! an! argon aye laser. '! The! effec of! the! laser! light
on! the! OpD! is! to! cause! oxygen! radicals to! be! released! which
destroy! the! surrounding! tumour! tissue. In! the! case! of
breast! cancer! the! illumination! stage! o the! treatment is
usually! given! twenty-four! to! seventy-two! hours! after
administration! of! the! HpD! agent,! though with! skin! cancer,
laser treatment! can! be delivered! up! to three! or! four! weeks
after! the! administration! of! the! HpD.

Conventionally! the! treatment! a! ea! has! been
illuminated! using! laser! light! directed down! an! optical
fibre,! the! tip! of! the! fibre! being! moved over! the! treatment
area. One! problem! with! this! method! is that! the! illumination
consists! of! an! intense! centre! spot! with the! intensity
falling! away! gradually! from! the! centre of! the! spot.! This
means! that! it! is! difficult! to! give! an! even! dosage! of! light
to! a! large! area_! Furthermore,! it! is! vry! easy! to! apply! too
much! light! to! some! areas.! In! order! to! attempt! to! alleviate
this! problem! it! has! been! proposed! to! deliver! the! light! using
an! optical! fibre! bundle! with! micro-lenses! on! the! end! of! each
fibre! or! diffusers! in! the! light! path! to! give! a! broader,! more
even,! illumination! 'area. Another! proposal! is! to! control! the
intensity! profile! of! the! beam! emerging! from! an! optical! fibre
by! interposing! an! oblique! glass! plate! between! the! laser! and
the! optical! fibre.

A! further! problem,! which! also! occurs! with! the

improved techniques mentioned above, **is**, however, that since the surface of the body being illuminated **is** to some extent reflective, it is difficult to determine exactly how much light is absorbed to act on the HpD. The reflectivity of different parts of the treatment area may vary and so even dosage estimates based on an estimated or measured reflectivity are not particularly good. A typical dosage estimate with one of the techniques above was that 30-400 J/cm² was delivered to the patient. It can be seen that the upper limit of the range is over ten times the lower limit and this is unsatisfactory both from the point of view of that treatment and for **statistically** processing the results from many treatments to try to improve the technique.

It has also been proposed to use laser light in other medical treatments, e.g. bio-stimulation in which tissue is irradiated with low power laser light. It has been suggested that this irradiation has certain beneficial effects and has been used to speed-up the healing of wounds, as a beauty treatment and in physiotherapy. Laser illumination has also been used in the treatment of vascular **abnormalities** such as port wine stain and the removal of tattoos. Other types of light **have** also been used, for instance, infra **red** or **ultra violet** for treating various conditions e.g. the treatment of skin disorders e.g. psoriasis. In some of these agents which render the **skin**


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sensitive! to! the! particular! light! bein^g used! have! been
administered to! the **patient**. **However**, similar! problems! with
achieving! a! uniform **illumination** and! calculating! the! amount
of! light! delivered! to! the! surface! have! been! found.

The! present! invention! provides! a! device! to! deliver! a
defined **quantity** of! light! to! a **surface! comprising** a! light
source! for! illuminating! the! surface! and! means! for! scattering
light! reflected! from! the! surface! so! that! it! can! be! directed
back! onto! the! surface.! Preferably! the! scattering! means! are
adapted! to! provide! ..a! substantially! uniform! illumination! of
the! surface.

In! more! detail! the! present! invention! provides
apparatus! for *illuminating* an! area! of! an! object,! comprising
a! delivery! device! including! a! light! source! for! illuminating
the! area! and! a! concave *diffusely* reflecting *surface*, wherein
the! diffuse! reflecting! surface! is! adapted! to! define! the! area
to! be! illuminated! when! the! device! is! held! in! contact! with
the! object! and! to! collect! light! reflected! from! the! surface
of the! object! and! scatter! it! back! towards! the! area.

Preferably! the! light! source,! which! conveniently! is
the! tip! of! an! optical! fibre,! is! arranged! to! illuminate! the
diffusely! reflective! surface! so! that! light! from! the! light
source! is! reflected! towards! the! treatment! area.! This! can! be
achieved! by! diffusing! the! light! with,! for! example, a ceramic
reflector! or! possibly! a p.t.f.e.! or! etched! diffuser! on! the



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optical fibre.

The present **invention** also provides a method of illuminating an area of an object comprising the steps of:

illuminating the area of the object with light from a light source illuminating a **concave** diffusely reflective **surface maintained confronting the area**

positioning the diffusely reflecting surface with its edges in contact with the objects that it collects light reflected from the surface of the object and scatters it back towards the area and so that the edges of the concave diffusely reflecting surface define the area being illuminated.

The light used may be laser light as in the conventional PDT techniques or may be non-coherent light for some applications. The diffusely reflective surface may be the inner, concave surface of a part-spherical, e.g. hemispherical, shell-like structure with the optical fibre and diffusing device attached in its top. In use, the shell is held with its edges in contact with the object under illumination so that any light reflected off the illuminated area is collected **and scattered back thereto by** the diffusely reflective surface. A reflectivity of 99% can be achieved by coating the concave surface with reflective paint, or any suitable highly reflective coating, e.g. a ceramic.

If! the! area! to **be** illuminated! is! smaller! than! the base! area! of! the! hemisphere! then! parts! of! the! area! which! do not **require! illumination! can** be! masked! with! a! highly **reflective! surface**. This **means** that! l! ght! striking! the reflective! surface! is! not! lost **but** is e! flected! back! towards the **diffusely** reflective **surface** and! a **entually-onto!** the area! to! be! illuminated.

It! will! be! appreciated! that! wi! h! the! present invention! the! amount! of! light! deliver! e! to! the-treatment area! can! be! accurately! determined! sine! :! none! of! the! light delivered! to! the! area! is! allowed! to! escape! .! This! is! because almost! all! of! the! light! reflected! from! the! illuminated! area is! scattered! back! towards! it! by! the! di! fuse! reflective surface! and! since! the! reflective! surfa! •e! is! held! in! contact with! the! object,! no! light! can! escape! u! der! the! edges. Furthermore,! the! use! of! a! diffusing! de! ice! on! the! end! of! the optical! fibre! delivering! the! laser! lig! t! and! the! use! of-the diffusely! reflective! surface! mean! that! the! intensity! of! the illumination! is **substantially** uniform! •ver! the! whole! of! the treatment! area.

The! invention! also! has! benefit-! for! the! safety! of the! operator! and,! if! it! is! being! used! n! medical! treatment, for! the! patient,! as! once! the! reflectiv! surface! is! in contact! with! the! body! the! laser! system! is! closed! and! there is! very! .! little! risk! of! accidental! inju! y! to! the! operator! or

to! the! patient! caused! by! escaping! las! r! light.! It! is possible! to! arrange! for! the! laser! or! cther! light! source! only to! be! switched! on! when! the! reflective! surface! is! placed! in contact! with! the **body!** - e.g.! by! a! pressure! sensitive! or temperature **sensitive! switch! or** by! some **other** switching means.

If! desired! the! target! to! be! illuminated! may! be treated! with! an! agent! to! absorb! the! light.! e.g.! a **photodegradable** or! photocensitizing! agent.! For! example where! the! invention! is! to! be! used! in! photodynamic! therapy, e.g.! for! the! treatment! of! cancer,! then! a! suitable! agent which! might! be! preferentially! absorbed! by! certain! cells! e.g. cancerous! cells,! e.g. *HpD* can! be! administered! to! the! patient some! hours! before! the! laser! treatment.! An! accurate! amount of! light! can! then! be! delivered **to** the! treatment! area! and this! allows! the! operator! to! calculate! more! accurately! what depth! of! tissue! may! be! destroyed.! This! not! only! allows better! treatment **of** an **individual** pati! nt! but! also **allows** a better! correlation-! of! results! to! treat! ent! conditions! and! so the! best! conditions! for! the! treatment! f! the! cancer! and different! types *of* cancer! may! be! determined! more! easily.

The! invention! is! also! useful! fr! the! treatment! of port! wine! stains, **homeopathic** processe! and! bio-stimulation where! the! fact **that** the **illumination** i uniform **and! defined** allow! better! control! of! the! treatment 'rocess.

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The! invention! has! been! describ
to! use! in! medical! treatment,! e.g.! for-
It! is,! however,! useful! in **any** process
to! uniformly! illuminate! an! area! and! to
by! reflection! from! that! area.! Thus! th
in! industrial! processes! for! manufactur
substances! e.g.! plastic! resin! composit
processes! in! the! manufacture! of! electr
microchips. In! such! processes! the! fac
escapes! and! that! a well! defined! area! i
that! the! process! can! be! run! economical
processes! types! of! electromagnetic! rad
optical! laser! light! might! be! appropria

The! device! may! also! be! useful
biological! growth! of **animals** ox! partic
again! the! fact! that! the! illumination! i
and! no! radiation! is! allowed! to! escape
efficiency! and! economy! of! the! process.

The! shape! of! the! reflective! su face! is! not! thought
to! be! particularly! critical,! the! prefer **red! embodiment! in**
this! specification! uses! a! hemisphere! bu **t! other! concave**
shapes! can! be! used.

The! size! of! shell! is! chosen! to be close! to! the! size
of! the! area! to! be! illuminated.

A! typical! size! of! shell! used! for! medical! purposes

d! above! in! relation
hotodynamic! therapy.
here! it! is! desirable
avoid! losing! light
device! could! be! used ,
e.g.! for! curing
s! or! for! optical
nic! devices! e.g.
that! no! light
illuminated! mean
y. Clearly! for! such
ation! other! than
e.

or! promoting
larly! plants,! where
accurately! defined
an! improve! the

-! 9! -

would! be! a! few! inches! in! diameter,! but **larger! or! smaller**
shells,! e.g.! large! enough! to! cover! the **complete! pelvic! area,**
may! also! be! used! where! appropriate.! I **is! also! possible! for**
the! reflective! surface! to! be! formed! on **a! flexible** member! so
that! it! can! be **shaped** to! match! the shape! of! the! area! to! be
treated. These! allow! the! operator to void treating! areas
which! do! not! need! treatment.

As! an! alternative! to! using a! diffusing! device! on! the
end! of! the! optical! fibre,! the! fibre! may! be! mounted! to! direct
light! onto! a! diffuse! reflector,! made! from,! e.g.! a! reflective
ceramic,! mounted! in! front! of! the! diffusely! reflective
surface! to! reflect! the! light! back! onto! it.

The! apparatus! may! further! comprise! a! deformable
sheet! of! material! across! the! open! end! of! the! concave
surface,! e.g.! a! sheet! of! white! rubber! or! synthetic! rubber,
and! which! has! a! high! reflectivity,! appreciable! transmission
and! low-absorption. The! absorption! should! be! low! enough! to
prevent! undesirable! light! loss,! e.g.! ab! ut! 1%,! and! the
transmission! high! enough! to! allow! suffi! ient! illumination! of
the! target! surface.! For! medical! applic! tions! about! 9% is
acceptable. The! reflectivity! should! be! for! such
applications,! about! 90%.

The **invention** will! be **further** d! scribed **by** way! of
non-limitative! example with! reference! t! the **accompanying**
drawings! which: -

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Figure 1 is a cross-sectional view of one embodiment of the invention;

Figure 2 is a partially cutaway view of the embodiment of Fig 1 in use;

Figure 3 is a schematic view of a second embodiment of the invention in use;

Figure 4 shows a third embodiment of the present invention; and

Figure 5 shows a fourth embodiment of the invention

As can be seen by Fig 1 the apparatus comprises a light delivery device 1 which consists of a hemispherical relatively rigid, plastics shell 3 whose inside, concave surface is coated with a reflective coating 5. The coating is a reflective paint or ceramic which provides a diffuse reflective surface. It is possible to achieve a reflectivity as high as 99% or more with such a coating. The shell, intended for medical use in PDT is about 5-15cm in diameter and about 1-2mm thick.

Laser light is supplied to the device along an optical fibre 7, which may be a single fibre or a bundle of fibres. In this embodiment the fibres are teflon coated and retained within a p.t.f.e. sheath 9. The fibres terminate at a diffusing element 11, which is in this embodiment a p.t.f.e. cylinder or, alternatively, a ceramic or etched fibre diffuser (formed by exposure to hydrofluoric acid)

11! -

mounted in the **hemispherical** shell. The fibre is connected to the shell by a two-part block 13 having a bore *down* the centre through which the fibre and sheath pass. **The fibre** is trapped in an interference fit between the two parts of the block 13. In the illustrated embodiment the diffuser 11 is positioned about 2cm below the top of the shell. Light transmitted down the fibre passes into the diffuser 11 and is emitted from the end **of** the diffuser in a number of directions. Some light will be transmitted directly to the treatment surface, but some light **will** also be transmitted towards the diffusely reflective surface 5. Various light paths are shown in the diagram. Light striking the diffusely reflective surface will be scattered therefrom, partly towards the treatment area and partly towards opposing regions of the reflector. It will be appreciated, therefore, that a fairly uniform illumination is achieved within the region defined by the edges of the reflective shell.

Although not shown in the diagram, the shell may be provided with a sensor and switch so that the laser supplying light to the optical fibre is only switched on when the shell is pressed into contact with the surface which is to be illuminated. This results *in* less chance of the patient or operator being accidentally exposed to laser light and thus improves the safety of the apparatus.

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In Fig. 2 the device is shown schematically in use on part of a patient 15. This shows the device used in a situation where the area 17 which is to be illuminated is **smaller than the base area of the reflector**. The parts of skin which would undesirably be exposed to the light have therefore been masked using a reflective tape 19, -for example, aluminium tape. This means that light supplied to the delivery device 11 which misses the **exposed treatment area** and hits the tape is reflected back up to the **diffusely reflective surface** and scattered back towards the treatment area.

Figure 3 shows a second embodiment of the invention in use. In this embodiment the reflective shell 22 is formed from a flexible plastics material so that it may be deformed to cover a desired treatment area more accurately. A further feature of this embodiment, which can also be used in the other embodiments of the invention, is that light is supplied to the device by several optical fibres 27 **each** connected to a diffusing device 11 and spaced over the surface of the shell. This enables a greater amount of light to be delivered per unit time if necessary and helps in maintaining a substantially uniform light distribution **particularly** in the case where the shell is deformed.

The above embodiments have been described as being supplied with laser light by an optical fibre. However, the

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invention is! also usable in! other applications! in! which! e.g. ultra! violet! or! infra! red! light! or! any! electromagnetic! wave radiation! are! used.! in! such! applications! the! light! may! be delivered! to! the! delivery! device! using! a! light! guide! e.g. liquid! or! fibre! light! guide! or! other! t! pes! of! radiation guides! or! the! light! source! may! be! moun! ed! in! or! on! the shell.

Figure 4! shows! schematically a! third! embodiment of the invention in! which! light delivered to! the *device by* an optical! fibre! 9! is! directed! onto! a! ref! ector! 30! in! this! case spherical,! though! other! shapes! may! be! sed,! which! reflects light! back! upon! to! the! diffusely! refle! tive! surface! which, in! turn,! scatters! it! onto! the! treatmen! area.! The! reflector 30,! which! may! be! a! highly! reflective! c! ramic,! is! mounted! on the! shell! 1! by! a! mounting! 32.

Figure! 5! shows! disgrammaticall! a! fourth! embodiment of! the! invention! which! uses! a! reflecto! 1! and! light! delivery system! 9! and! 30! as! in! the! previous! emb•diments,! but! also includes! a! deformable! partly! reflectiv=! partly! transmissive sheet! 50! across! the! open! end! of! the! reflector! which,! in use,! covers! the! target! area.! The! sheer! 50! may! be! a! sheet! of white! rubber! or! synthetic! rubber! and! h-s! a! high! reflectance preferably! greater! than! 17%! and! more! p! eferably! still greater! than! 77%! ,! very! low! absorttion! •referably! less! than 5%! and! appreciable! transmission. Typi.al! values! which! have

been effective in practice are, for instance, . 90% reflection, 9% transmission and 1% absorption. This sheet 50 is particularly useful when the device is used to illuminate an uneven surface as it confirms or partly confirms to that surface and improves the uniformity of the light delivered to the target.

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With the invention it is possible to calculate the amount of light supplied to the treatment area much more accurately than with the prior art devices. This is because substantially all of the light supplied to the device is eventually absorbed by the treatment surface. None is allowed to escape - because the reflector shell is placed in contact with the object being illuminated and any light reflected from the treatment surface is eventually scattered back by the diffuse reflector towards the treatment surface. Furthermore, the fact that virtually none of the light supplied to the device is allowed to escape means that the device is particularly safe to use.

While the invention has been described in relation to the medical treatments, as discussed above it is applicable wherever it is required to deliver an accurate and uniform irradiation to a surface, or to substantially reduce the amount of light lost from a system, or to define the area to which radiation should be delivered. The effect of this device in minimizing losses has benefits in that for

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a! given! total! energy! absorption! requir! ment! for! a! given
power! output! of! the! radiation! source,! less! time! will! be
needed! to! bring! about! that! effect.

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CLAIMS

1. **Apparatus to deliver a defined quantity of light to a surface comprising a light source for illuminating the surface and means for scattering light reflected from the surface so that it can be directed back onto the surface.**

2. **Apparatus according to claim 1 wherein the scattering means are adapted to provide a substantially uniform illumination of the surface.**

3. **Apparatus for illuminating an area of an object, comprising a delivery device including a light source for illuminating the area and a concave diffusely reflecting surface, wherein the diffusely reflective surface is adapted to define the area to be illuminated when the device is held in contact with the object and to collect light reflected from the surface of the object and scatter it back towards the area.**

4. **Apparatus according to claim 3 wherein the light source is adapted to illuminate the diffusely reflective surface so that light from the light source is scattered towards the area of the object.**

5. **Apparatus according to claim 3 or 4 wherein the light source is a source of laser light**

6. **Apparatus according to claim 3, 4 or 5 wherein**

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the! light! source! includes! an! element! for! distributing! the
light! onto! the! reflecting! surface.

7. Apparatus! according! to! cl! im! 6! wherein! the
element! is! a! diffusely! reflecting! body

8. Apparatus! according! to! claim! 6! wherein! the
element! is! a! p.t.f.e.! cylinder.

9. Apparatus according! to! an! one! of! the! preceding
claims! wherein! the! diffusely! reflectiv! surface! is! the
concave! surface! of! a! shell-like! struct! re,! the! edges! of! the
shell! defining! the! area! to! be! illuminated! when! it! is! held! in
contact! with! the! object.

10. Apparatus! according! to! claim! 9! wherein! the
concave! surface! is! coated! with! a! reflective! ceramic! to! form
the! diffusely! relect.ive! surface.

11. Apparatus! according! to! anj one! or! the! claims! 3
to! 10! further! comprising! a! deformable heet! of! material
across! the! open-end! of! the! concave! surf ace,! said! material
having! a high! light! reflectance, **apprec** iable! light
transmission! and! low! light! absorption! flor! the! light! from
said light! source.

12. A! method! of! illuminating! an! area **of** an! object
comprising! the! steps! of:

illuminating the! area! of! the! object! with! light! from
a! light! source! preferably! a! laser! light! source,! illuminating
a! concave! diffusely! reflective! surface! maintained

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confronting! the! area,

and! positioning! the! diffusely! reflecting! surface
with! its! edges! in! contact! with! the! object! so! that! it
collects! light! reflected! from! the! surf-ce! of! the! object! and
scatters! it! back! towards! the! area! and! o! that! the! edges! of
the! concave! diffusely! reflecting! surfa! e! define! the! area
being *illuminated*.

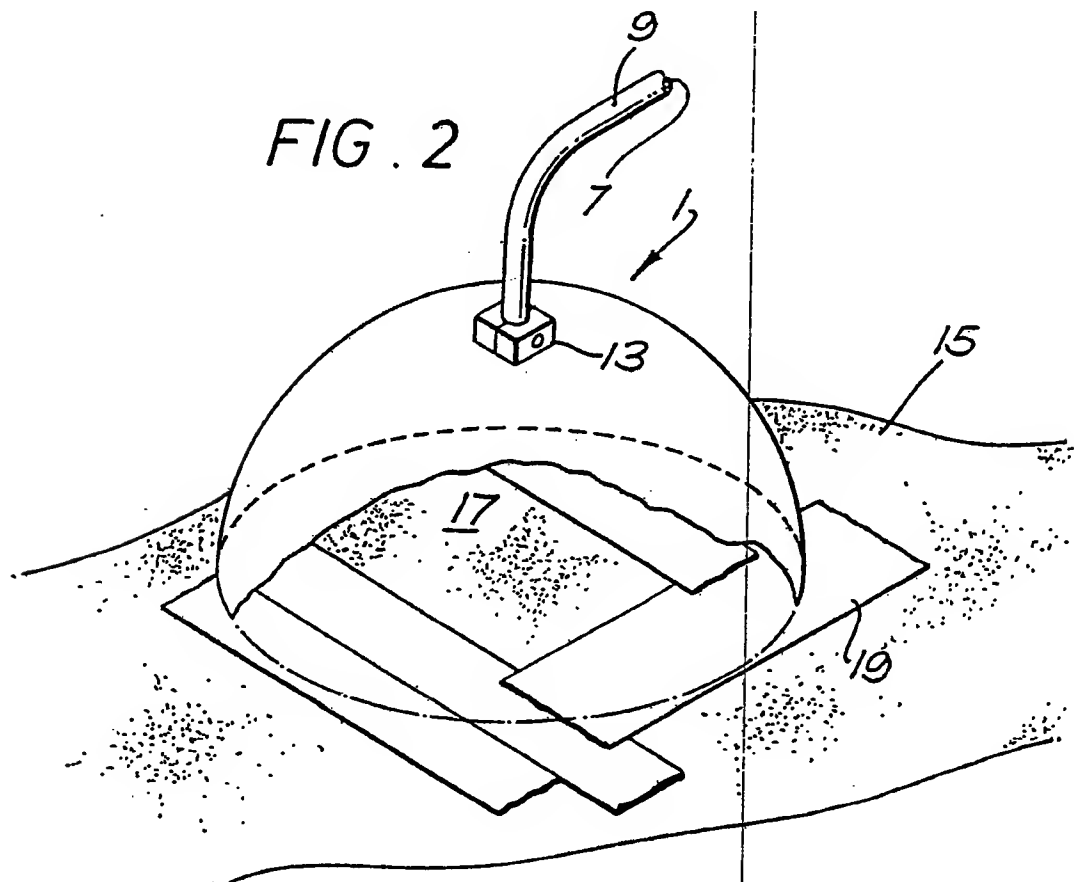
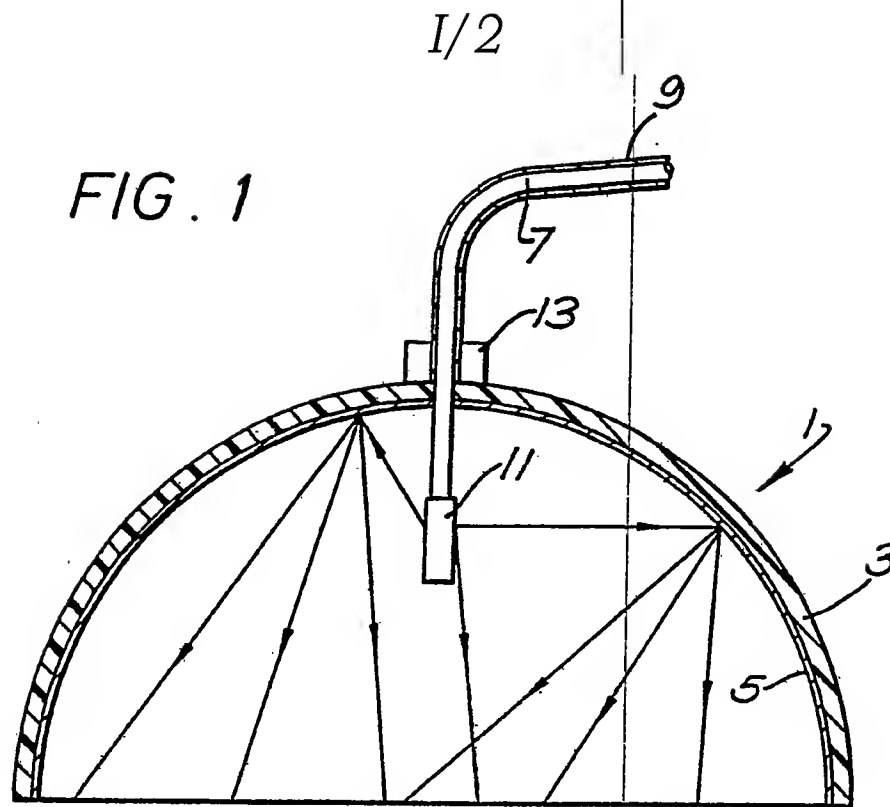
b

13. A! method! according! to! cia 12! wherein! the
diffusely! reflecting! surface! is! illumi! ated! by! light
delivered! by! an! optical! fibre! to! a! dif! user,! e.g.! of! ceramic
or! a! p.t.f.e.! cylinder,

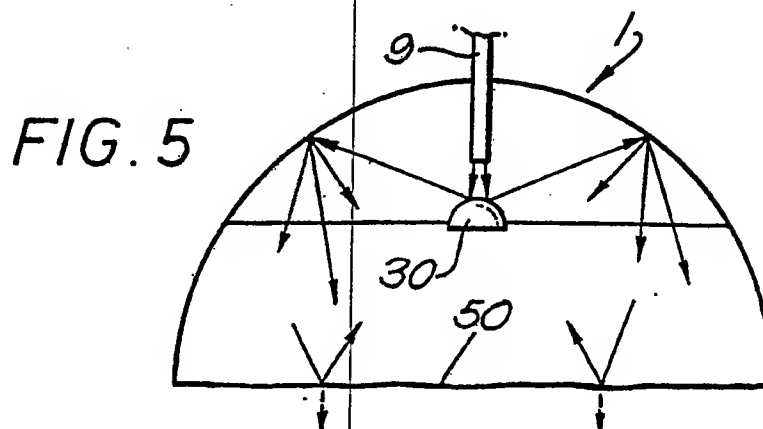
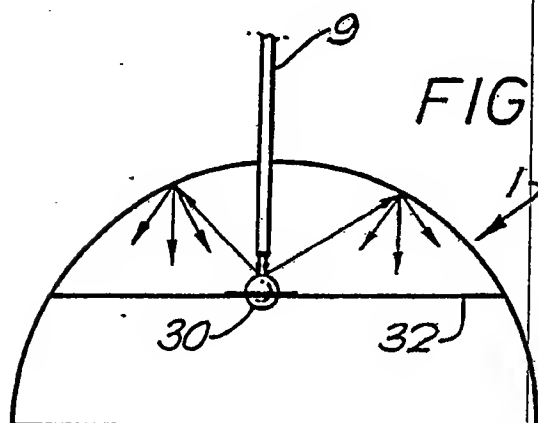
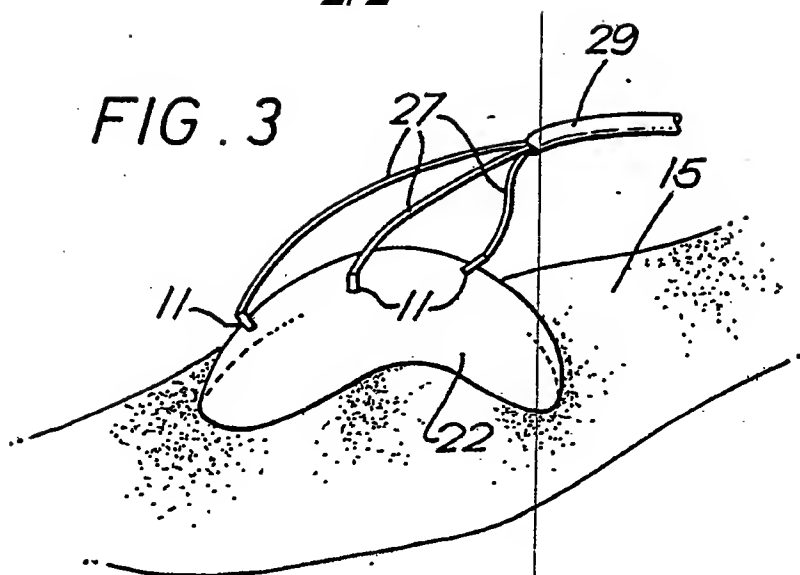
14. A! method! according! to! claim! 12! or! 13! wherein
the! area! is! provided! of! with! a! degradable! agent! for
absorbing! the! light.

15. A! method! according! to! cla 12,13! or! 14,
wherein! light! from! the! concave! surface! is! transmitted
through! a! deformable! sheet! covering! th! surface,! the! sheet
having! properties! of! high! light! reflec! ance,! appreciable
light! transmission! and! low! light! absor! tion.

II



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INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 89/00796

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ^r			
According to International Patent Classification (IPC) or to both National Classification and IPC			
Ipc5: A 61 N 5/06			
ii. FIELDS SEARCHED			
Minimum Documentation Searched ⁷			
Classification System		Classification Symbols	
IPC5		A 61 N, A 61 B	
Documentation Searched other than Minimum Documentation to the extent that such Documents are Included in the Fields Searched ⁸			
iii. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹			
Category ¹⁰	Citation of Document, ¹¹ with Indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	
X	FR, A 2591902 (COLLIN) 26 June 1987, see page 3, lines 28-32; page 6, figure 4 --	1-5, 9, 12	
X	D.E, A 3300517 (MERSMANN) 26 July 1984, see page 9, lines 12-20; page 52, lines 32-37; page 99, lines 9-33; figures 93-96	1-10, 12	
<p>Special categories of cited documents: ¹⁴</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"L" document which may throw doubts on priority claims or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, user, exhibition or other means</p> <p>"P" document published not to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date and not in conflict with the application but understood the principle or theory underlying the invention</p> <p>"Y" document of particular relevance; the claimed invention considered novel or cannot be considered to involve an inventive step</p> <p>"3" document of particular relevance; the claimed invention considered to involve an inventive step when the is combined with one or more other such documents, the combination being obvious to a person skilled member of the same patent family</p>			
IV. CLERIFICATION			
Date of the Actual Completion of the International Search	Date of Mafin	of this International Search Report	
18th October 1989		3 ~t~(n, 11' 989	
International Searching Authority	Signature of A	thorised 0	
EUROPEAN PATENT OFFICE		T.K. WILLI	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

**GB 8900796
SA 30105**

This annex lists the patent family members relating to the patent documents cited in th¹ above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 08/11/89
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Patent document cited in search report	Publication date	Patent family members)	Publication date
FR--A- 2591902 -----	26-06-87	None	-----
'DE-A- 330(1517	26-07-84	None	